

General

Guideline Title

Evaluation and management of blunt traumatic aortic injury: a practice management guideline from the Eastern Association for the Surgery of Trauma.

Bibliographic Source(s)

Fox N, Schwartz D, Salazar JH, Haut ER, Dahm P, Black JH, Brakenridge SC, Como JJ, Hendershot K, King DR, Maung AA, Moorman ML, Nagy K, Petrey LB, Tesoriero R, Scalea TM, Fabian TC. Evaluation and management of blunt traumatic aortic injury: a practice management guideline from the Eastern Association for the Surgery of Trauma. *J Trauma Acute Care Surg*. 2015 Jan;78(1):136-46. [57 references] [PubMed](#)

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Nagy K, Fabian T, Rodman G, Fulda G, Rodriguez A, Mirvis S. Guidelines for the diagnosis and management of blunt aortic injury: an EAST Practice Management Guidelines Work Group. *J Trauma*. 2000 Jun;48(6):1128-43. [144 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

The strength of recommendation (strong or weak/conditional) and levels of evidence (high, moderate, low or insufficient) are defined at the end of the "Major Recommendations" field.

Population, Intervention, Comparator, and Outcome (PICO) Question 1

In patients with suspected blunt traumatic aortic injury (BTAI), should computed tomography (CT) of the chest with intravenous contrast be used versus conventional catheter-based angiography for the identification of clinically significant BTAI?

Recommendation

Despite the overall quality of evidence being low, the panel considered that most patients would place a high value on identification of clinically significant BTAI. The sensitivity of CT of the chest is comparable with aortography. There are also a higher number of "false positives" with CT of the chest, indicating that this screening modality may potentially identify minimal aortic injuries not identified on aortography. Furthermore, CT of the chest with intravenous contrast has the advantage of being readily available, less invasive, being less time consuming, and allowing for

identification of other intrathoracic injuries. All of these factors resulted in the formulation of a strong recommendation by the committee.

In patients with suspected BTAI, the guideline committee strongly recommends the use of CT scan of the chest with intravenous contrast for diagnosis of clinically significant BTAI.

PICO Question 2

In patients with BTAI, should endovascular repair be performed versus open repair to minimize mortality, stroke, paraplegia, and renal failure?

Recommendation

Despite the overall quality of evidence being low (mortality, stroke) to moderate (paraplegia), the panel considered that most patients would place a high value on a less invasive procedure that carries a significantly lower risk of blood loss, mortality, and paraplegia and a comparable risk of stroke. The panel also considered the fact that endovascular repair is performed more frequently than open repair, resulting in decreased experience with and training in open repair. In addition, initial concerns regarding a high rate of device-related complications seem unfounded as the current literature suggests that complication rates are low and continue to improve as technology evolves. All of these factors resulted in the formulation of a strong recommendation by the committee.

In patients diagnosed with BTAI, the guideline committee strongly recommends the use of endovascular repair in patients who do not have contraindications to endovascular repair.

PICO Question 3

In patients with BTAI, should timing of repair be delayed or immediate to minimize mortality, stroke, paraplegia, and renal failure?

Recommendation

The overall quality of evidence ranged from very low (stroke) to high (paraplegia). However, the panel considered that most patients would place a high value on BTAI repaired in a delayed fashion because it results in decreased mortality and paraplegia. Rates of renal failure were nearly identical. The panel discussed the fact that the patients who benefit the most from delayed repair are those who have major associated injuries. These patients clearly require resuscitation and treatment of immediately life-threatening injuries before aortic repair. The data are not as clear for patients without associated injuries who have no reason to undergo delayed repair. The panel *does not* advocate delaying repair of BTAI (e.g., until the following weekday morning) merely for surgeon convenience. Although the studies included in the evidence profile demonstrated decreased incidence of mortality, stroke, and paraplegia with delayed repair, it should be noted that the reason the majority of patients in these studies underwent delayed repair was because they had associated life-threatening injuries and/or a requirement for further resuscitation. Only one study evaluated the effect of delayed repair in a select group of patients without major associated injuries, and the number of patients in this group was small (n=108). It is important to consider that in that group of patients, the benefit of delayed repair was only related to mortality. The incidence of paraplegia and renal failure in this subset of patients was higher. The consideration of these factors resulted in the formulation of a conditional recommendation by the committee.

In patients diagnosed with BTAI, the guideline committee suggests delayed repair. It is critical that effective blood pressure control with antihypertensive medication is used in these patients.

Definitions:

Grading of Recommendations Assessment, Development and Evaluation (GRADE) Methodology Levels for Rating the Quality of Evidence

Quality Level	Definitions
High	Very confident that the true effect lies close to estimate of effect.
Moderate	Moderate effect; true effect is likely close to estimate of effect but may be substantially different.
Low	Limited confidence; true effect may be substantially different from estimate of effect
Very Low	Little confidence; true effect likely substantially different from estimate of effect.

GRADE – Definition of Strong and Weak Recommendation

	Strong Recommendation	Weak/Conditional Recommendation
For patients	Most patients would want the recommended course of action.	Most patients would want the recommended course of action, but many would not.
For clinicians	Most patients should receive the recommended course of action.	Different choices will exist for different patients, and clinicians should help patients decide.
For policy makers	Recommended course should be adopted as policy.	Considerable debate and stakeholder involvement needed to make policy.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Blunt traumatic aortic injury (BTAI)

Guideline Category

Diagnosis

Evaluation

Management

Treatment

Clinical Specialty

Cardiology

Critical Care

Emergency Medicine

Internal Medicine

Radiology

Thoracic Surgery

Intended Users

Advanced Practice Nurses

Allied Health Personnel

Hospitals

Nurses

Physician Assistants

Guideline Objective(s)

To evaluate the choice of diagnostic imaging (chest computed tomography [CT] with intravenous contrast vs. conventional catheter-based angiography), type of surgical intervention (endovascular vs. open), and timing of surgical intervention (immediate vs. delayed) for patients with blunt traumatic aortic injury (BTAI)

Target Population

Patients with or suspected of having blunt traumatic aortic injuries (BTAs)

Interventions and Practices Considered

1. Computed tomography (CT) of the chest with intravenous contrast
2. Endovascular surgical repair
3. Delayed surgical repair of the aorta along with blood pressure control

Major Outcomes Considered

- Accuracy of the diagnosis of blunt traumatic aortic injury (BTAI)
- Morbidity (stroke, paraplegia, and renal failure) related to blunt aortic injury or complications of surgery
- Mortality

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Identification of References

With the assistance of an informationist, a search of the National Library of Medicine and the National Institutes of Health MEDLINE database was conducted using PubMed (www.pubmed.gov) with citations published between 1998 and 2013. The guideline committee used the "related articles" function to broaden the search and scan all citations for relevance. In addition to the electronic search, the bibliographies of recent reviews and articles were manually searched. Articles were limited to those in the English language involving human subjects. Letters to the editor, case reports, book chapters, and review articles were excluded. These articles were reviewed by the committee chair, and the final reference list of 60 citations was distributed to the remainder of the study group for review. Of these, 51 articles were felt to be appropriate for the construction of these guidelines and included in the construction of tables of the summary of findings.

Refer to the "Description of Methods Used to Formulate the Recommendations" field for the Population, Intervention, Comparator, and Outcome (PICO) questions referenced below.

PICO Question 1

A systematic review of the MEDLINE database using PubMed was performed with the search terms *angiography, blunt aortic injury, blunt thoracic aortic injury, computed chest tomography, and computed tomography angiography (CTA)* limited to dates from 1998 to 2013. Studies reporting total and false positives as well as total and false negatives for the use of CT with intravenous contrast and aortography were included for further review. Results for the sensitivity and specificity of both diagnostic tests were not pooled because of intrinsic limitations of the study of diagnostic test accuracy in different settings such as increased heterogeneity, nonstandardized designs, quality of testing, and incomplete confirmatory testing (intraoperative findings) in every patient.

PICO Question 2

A similar systematic search of the National Library of Medicine and the National Institutes of Health MEDLINE database was performed using PubMed. Search terms included *traumatic aortic injury, blunt aortic injury, blunt aortic trauma, endovascular aortic repair, and open aortic repair*. Additional references were identified by using two previously published meta-analyses that reported on studies published from 1990 to December 2010. Articles were reviewed by the committee chair, and the final reference list of 40 citations was distributed to the remainder of the study group for review. Of these, 38 articles were felt to be appropriate for the construction of these guidelines. One article that reported results on an analysis of a large national administrative database was ultimately excluded because of having a methodology significantly different from the rest of the studies. When comparing open versus endovascular repair, a total of 37 studies reported the outcome of mortality, 21 reported incidence of paralysis, and 12 reported incidence of stroke. With regard to renal failure, the available literature did not provide sufficient or consistent measurements across the studies, specifically if the onset of renal failure occurred before or after surgical intervention. Therefore, this outcome was not able to be included in the meta-analysis.

PICO Question 3

A similar systematic review of the MEDLINE database was performed using search terms *blunt aortic injury, traumatic aortic injury repair, immediate repair of blunt thoracic aortic injury, and delayed repair of blunt thoracic aortic injury* limited to dates from 1998 to 2013. No randomized trials comparing delayed versus early repair have been performed for BTAI. A final list of seven articles was reviewed by the study group. The outcomes of interest were mortality (reported in all studies), stroke (one study), paraplegia (three studies), and renal failure (three studies).

Number of Source Documents

The final reference list contained 60 citations. Of these, 51 articles were felt to be appropriate for the construction of these guidelines and included in the construction of tables of the summary of findings.

- Population, Intervention, Comparator, and Outcome (PICO) Question 1: Six articles contained the necessary information to construct Forest plots for sensitivity and specificity and were deemed appropriate for the construction of the guideline.
- PICO Question 2: A total of 38 articles were felt to be appropriate for the construction of these guidelines.
- PICO Question 3: Seven articles were reviewed by the study group and deemed appropriate for the construction of the guideline.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Grading of Recommendations Assessment, Development and Evaluation (GRADE) Methodology Levels for Rating the Quality of Evidence

Quality Level	Definitions
High	Very confident that the true effect lies close to estimate of effect.
Moderate	Moderate effect; true effect is likely close to estimate of effect but may be substantially different.
Low	Limited confidence; true effect may be substantially different from estimate of effect
Very Low	Little confidence; true effect likely substantially different from estimate of effect.

Methods Used to Analyze the Evidence

Meta-Analysis

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Data Extraction and Methodology

Population, Intervention, Comparator, and Outcome (PICO) Question 1

Results for the sensitivity and specificity of both diagnostic tests were not pooled because of intrinsic limitations of the study of diagnostic test accuracy in different settings such as increased heterogeneity, nonstandardized designs, quality of testing, and incomplete confirmatory testing (intraoperative findings) in every patient.

PICO Questions 2 and 3

For PICO Questions 2 and 3, the data for each included article were pooled, and relative risks (RRs) were calculated as measures of effect for dichotomous outcomes using Review Manager (RevMan, Cochrane Collaboration, version 5.2). Potential heterogeneity exists because of population differences as well as different types of surgery performed and how patients are defined. The guideline committee examined these differences across studies to assess the clinical and methodological heterogeneity. For the meta-analysis, they used RevMan to calculate the Q statistic, and then the I^2 statistic (%) was used to determine the proportion of variation between studies attributable to heterogeneity and categorized as "low" (25%-49%), "moderate" (50%-74%), or "high" (74%-100%). The committee also used the χ^2 test for heterogeneity and examined the confidence intervals (CIs) for overlap, with decreasing overlap representing increasing heterogeneity. All studies were analyzed using a random-effects model. Tables with summary of findings were constructed using GRADEpro (GRADE Working Group, version 3.2).

Grading the Evidence

PICO Question 1

With the use of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework for evaluating the data specifically related to the outcome of identification of clinically significant injury, no serious risk of bias, inconsistency, indirectness, imprecision, or publication bias was found. Therefore, the overall quality of evidence was low. Per GRADE methodology, if sensitivities and specificities are similar for the diagnostic tests in question, then the preference for one modality over the other may come from the availability of one modality over the other, ease of use, and the value of other secondary information obtained from the diagnostic test.

PICO Question 2

With the use of the GRADE framework for evaluating the data specifically related to the outcome of mortality, no serious risk of bias, inconsistency, indirectness, imprecision, or publication bias was found. The evidence could not be upgraded, and therefore, the overall quality was low. For the outcome of stroke, no serious risk of bias, inconsistency, indirectness, imprecision, or publication bias was found, and the evidence could not be upgraded. The overall quality of evidence for this outcome was low. For the outcome of paraplegia, no serious risk of bias, inconsistency, indirectness, imprecision, or publication bias was found. The evidence for this outcome was upgraded for a strong association, and the overall quality of evidence was moderate. An evidence profile was constructed using the GRADEpro software by importing the data from RevMan (see Figure 3 in the original guideline document).

PICO Question 3

With the use of the GRADE framework for evaluating the data specifically related to the outcome of mortality, no serious risk of bias, inconsistency, indirectness, imprecision, or publication bias was found. The evidence was upgraded for a strong association, resulting in the overall quality of evidence being moderate. For the outcome of stroke, no serious risk of bias, inconsistency, indirectness, or publication bias was found. However, the evidence was downgraded for imprecision, and the overall quality was very low. For the outcome of paraplegia, no serious risk of bias, inconsistency, indirectness, imprecision, or publication bias was found. The evidence was upgraded for a very strong association, and the overall quality was high. For the outcome of renal failure, no serious risk of bias, inconsistency, indirectness, imprecision, or publication bias was found. Therefore, the overall quality of evidence was low. An evidence profile was constructed using the GRADEpro software by importing the

data from RevMan (see Figure 5 in the original guideline document).

Qualitative Synthesis and Quantitative Synthesis (Meta-Analysis)

Please refer to the original guideline document for details of the qualitative synthesis and quantitative synthesis (meta-analysis) performed for each PICO question.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The issues of how to diagnose, treat, and manage blunt traumatic aortic injury (BTAI) were first addressed by the Eastern Association for the Surgery of Trauma (EAST) in the practice management guidelines (PMGs) on this topic published in 2000. The literature search for the previous guideline ended in 1997. During the past 15 years, there have been rapid advances in the management of BTAI. As a result, the EAST guidelines committee decided to develop updated guidelines for this topic using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework recently adopted by EAST.

Three PICO (Population [P], Intervention [I], Comparator [C] and Outcome [O]) questions were formulated:

1. In patients with suspected BTAI (P), should computed tomography (CT) of the chest with intravenous contrast (I) be used versus conventional catheter-based angiography (C) for the identification of clinically significant BTAI (O)?
2. In patients with BTAI (P), should endovascular (I) repair be performed versus open repair (C) to minimize risk of mortality, stroke, paraplegia, and renal failure (O)?
3. In patients with BTAI (P), should timing of repair be delayed (I) or immediate (C) to minimize risk of mortality, stroke, paraplegia, and renal failure (O)?

Outcome Measure Types

Per the GRADE approach, outcomes were chosen by the committee and rated in importance from 1 to 9, with scores of 7 to 9 representing critical outcomes. For PICO Question 1, the following outcomes were considered by the committee members: identification of clinically significant aortic injury, rapid diagnosis of aortic injury, complications associated with invasive procedures, cost, and patient transport. For PICO Questions 2 and 3, the following outcomes were considered by committee members: mortality, paraplegia, stroke, acute renal failure, length of stay, and cost. Not all of these criteria were deemed "critical" by the committee for the decision-making process within the GRADE framework. Therefore, the critical outcome for PICO Question 1 was determined to be the identification of clinically significant aortic injury. The critical outcomes for PICO Question 2 were mortality, stroke, paraplegia, and renal failure. The critical outcomes for PICO Question 3 were mortality, stroke, paraplegia, and acute renal failure.

Formulation of Recommendations

Within the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework, once the overall quality of evidence across studies and outcomes is determined, the guideline panel formulates a recommendation that considers the following: quality of evidence, patients' values and preferences, and cost/resource use.

Rating Scheme for the Strength of the Recommendations

Grading of Recommendations Assessment Development, and Evaluation (GRADE) – Definition of Strong and Weak Recommendation

	Strong Recommendation	Weak/Conditional Recommendation
For patients	Most patients would want the recommended course of action.	Most patients would want the recommended course of action, but many would not.
For clinicians	Most patients should receive the recommended course of action.	Different choices will exist for different patients, and clinicians should help patients decide.

For policy makers	Recommendation should be adopted as policy.	Considerable stakeholder involvement needed to make recommendation.
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Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

All authors participated in the critical review of all versions of this article.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

The benefits of delayed repair in terms of mortality (22% early vs. 3% delayed), paraplegia (3% early vs. 0% delayed), and renal failure (38% early vs. 29% delayed) for patients with major extrathoracic injuries are significant. The mortality benefit of delayed repair (14% early vs. 8% delayed) was still present in patients without major extrathoracic injuries, although not as significant.

Potential Harms

- Overall specificity is lower for computed tomography (CT) as compared with aortography, indicating that there may be a higher number of "false-positive" results when using CT scan.
- One of the primary concerns with endovascular repair in earlier studies was the reported high rate of device-related complications. In the American Association for the Surgery of Trauma (AAST) series, 32 device-related complications developed in 25 patients (20%). Although the most common complication was endoleak (14%), other complications included access-vessel injuries, occlusion of the left subclavian or left common carotid artery, and late migration and thrombosis of the stent graft.

Qualifying Statements

Qualifying Statements

- The Eastern Association for the Surgery of Trauma (EAST) is a multi-disciplinary professional society committed to improving the care of injured patients. The Ad hoc Committee for Practice Management Guideline Development of EAST develops and disseminates evidence-based information to increase the scientific knowledge needed to enhance patient and clinical decision-making, improve health care quality, and promote efficiency in the organization of public and private systems of health care delivery. Unless specifically stated otherwise, the

opinions expressed and statements made in this publication reflect the authors' personal observations and do not imply endorsement by nor official policy of EAST.

- "Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances."^{*} These guidelines are not fixed protocols that must be followed, but are intended for health care professionals and providers to consider. While they identify and describe generally recommended courses of intervention, they are not presented as a substitute for the advice of a physician or other knowledgeable health care professional or provider. Individual patients may require different treatments from those specified in a given guideline. Guidelines are not entirely inclusive or exclusive of all methods of reasonable care that can obtain/produce the same results. While guidelines can be written that take into account variations in clinical settings, resources, or common patient characteristics, they cannot address the unique needs of each patient nor the combination of resources available to a particular community or health care professional or provider. Deviations from clinical practice guidelines may be justified by individual circumstances. Thus, guidelines must be applied based on individual patient needs using professional judgment.
- These guidelines represent a detailed summary and comprehensive overview of the literature regarding the evaluation and treatment of blunt traumatic aortic injury (BTAI). They are meant to inform the decision-making process and not replace clinical judgment. Patients with BTAI have a high mortality rate.

*Institute of Medicine. Clinical practice guidelines: directions for a new program. MJ Field and KN Lohr (eds) Washington, DC: National Academy Press. 1990: pg 39.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Timeliness

Identifying Information and Availability

Bibliographic Source(s)

Fox N, Schwartz D, Salazar JH, Haut ER, Dahm P, Black JH, Brakenridge SC, Como JJ, Hendershot K, King DR, Maung AA, Moorman ML, Nagy K, Petrey LB, Tesoriero R, Scalea TM, Fabian TC. Evaluation and management of blunt traumatic aortic injury: a practice management guideline from the Eastern Association for the Surgery of Trauma. J Trauma Acute Care Surg. 2015 Jan;78(1):136-46. [57 references] [PubMed](#)

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2000 Jun (revised 2015 Jan)

Guideline Developer(s)

Eastern Association for the Surgery of Trauma - Professional Association

Source(s) of Funding

Eastern Association for the Surgery of Trauma (EAST)

Guideline Committee

Eastern Association for the Surgery of Trauma (EAST) Practice Management Guidelines Committee

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

The authors declare no conflicts of interest.

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Nagy K, Fabian T, Rodman G, Fulda G, Rodriguez A, Mirvis S. Guidelines for the diagnosis and management of blunt aortic injury: an EAST Practice Management Guidelines Work Group. J Trauma. 2000 Jun;48(6):1128-43. [144 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Electronic copies: Available from the [Eastern Association for the Surgery of Trauma \(EAST\) Web site](#) .

Print copies: Available from the Eastern Association for the Surgery of Trauma Guidelines, c/o Nicole Fox, MD, Trauma, Critical Care, Emergency Surgery, Cooper University Hospital, 1 Cooper Plaza, Camden, NJ 08103; email: fox-nicole@cooperhealth.edu.

Availability of Companion Documents

The following is available:

- Kerwin AJ, Haut ER, Burns JB, Como JJ, Haider A, Stassen N, Dahm P, Eastern Association for the Surgery of Trauma Practice Management Guidelines Ad Hoc Committee. The Eastern Association of the Surgery of Trauma approach to practice management guideline development using Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology. J Trauma Acute Care Surg. 2012 Nov;73(5 Suppl 4):S283-7. Electronic copies: Available from the [Eastern Association for the Surgery of Trauma \(EAST\) Web site](#) .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on March 9, 2001. The information was verified by the guideline developer on May 4, 2001. This summary was updated by ECRI Institute on March 6, 2015. The updated information was verified by the guideline developer on March 28, 2015.

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